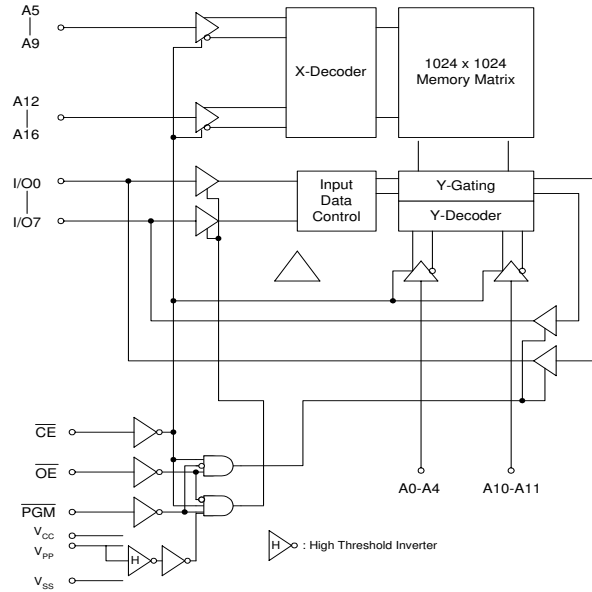
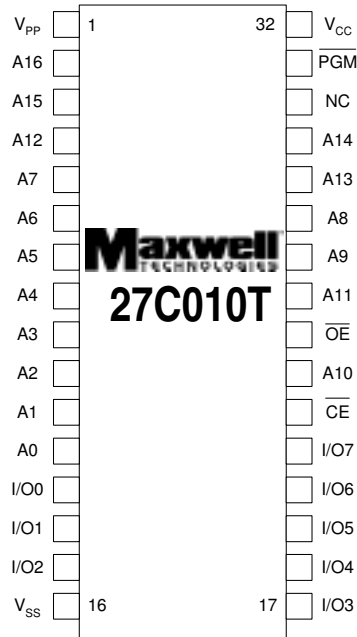


27C010T

1 Megabit (128K x 8-Bit) - OTP EPROM



Logic Diagram

FEATURES:

- 128k x 8 Bit OTP EPROM organization
- RAD-PAK® radiation-hardened against natural space radiation
- Total dose hardness:
 - >100 krad (Si), depending upon space mission
- Excellent Single Event Effects:
 - SEL_{TH} LET: > 80 MeV/mg/cm²
 - SEU_{TH} LET (read mode): >80 MeV/mg/cm²
- Package:
 - 32 pin RAD-PAK® flat pack
 - Weight - 6.0 grams
- Fast access time:
 - 120, 150, 200 ns (max) times available
- Low power consumption:
 - Active mode: 50 mW/MHz (typ)
 - Standby mode: 5µW (typ)
- High speed page and word programming:
 - Page programming time: 14 sec (typ)
- Programming power supply:
 - V_{pp} = 12.5 V ± 0.3 V
- One-time Programmable
- Pin Arrangement
 - JEDEC standard byte-wide EPROM
 - Flash memory and mask ROM compatible

DESCRIPTION:

Maxwell Technologies' 27C010T high density 1 Megabit One-time Programmable Electrically Programmable Read Only Memory microcircuit features a greater than 100 krad (Si) total dose tolerance, depending upon space mission. The 27C010T features fast address times and low power dissipation. The 27C010T offers high speed programming using page programming mode. The 27C010T is offered in JEDEC-Standard Byte-Wide EPROM pinouts, which allows socket replacement with Flash Memory and Mask ROMs.

Maxwell Technologies' patented RAD-PAK® packaging technology incorporates radiation shielding in the microcircuit package. It eliminates the need for box shielding while providing the required radiation shielding for a lifetime in orbit or space mission. In a GEO orbit, RAD-PAK provides greater than 100 krad (Si) radiation dose tolerance. This product is available with screening up to Class S.

TABLE 1. 27C010T PINOUT DESCRIPTION

PIN	SYMBOL	DESCRIPTION
12-5, 27, 26, 23, 25, 4, 28, 29, 3, 2	A0 - A16	Address
	I/O0 - I/O7	Input/Output
22	\overline{CE}	Chip Enable
24	\overline{OE}	Output Enable
32	V _{CC}	Power Supply
1	V _{PP}	Programming Supply
16	V _{SS}	Ground
31	\overline{PGM}	Programming Enable
30	NC	No Connection

TABLE 2. 27C010T ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	MIN	MAX	UNIT
Supply Voltage ¹	V _{CC}	-0.6	7.0	V
Programming Voltage ¹	V _{PP}	-0.6	13.5	V
All Input and Output Voltage ^{1,2}	V _{IN} , V _{OUT}	-0.6	7.0	V
A9 Voltage ²	V _{ID}	-0.6	13.0	V
Operating Temperature Range	T _A	-55	+125	°C
Storage Temperature Range	T _S	-65	+150	°C

1. Relative to V_{SS}.

2. V_{IN}, V_{OUT}, and V_{ID} min = -1.0V for pulse width ≤ 20 ns.

TABLE 3. DELTA LIMITS

PARAMETER	VARIATION
I _{CC1}	±10% of value specified on Table 6
I _{CC2}	±10% of value specified on Table 6
I _{CC3}	±10% of value specified on Table 6
ISB	±10% of value specified on Table 6

TABLE 4. 27C010T RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN	MAX	UNITS
Supply Voltage	V_{CC}	4.5	5.5	V
Input Voltage	V_{IL}	-0.3 ¹	0.8	V
	V_{IH}	2.2	$V_{CC} + 1^2$	
Thermal Impedance	Θ_{JC}	--	1.27	°C/W
Operating Temperature Range	T_A	-55	+125	°C

1. V_{IL} min = -1.0V for pulse width \leq 50 ns.
2. V_{IH} max = $V_{CC} + 1.5V$ for pulse width \leq 20 ns.

TABLE 5. 27C010T CAPACITANCE ¹

PARAMETER	SYMBOL	MIN	MAX	UNIT
Input Capacitance	C_{IN}	--	10	pF
Output Capacitance	C_{OUT}	--	15	pF

1. Guaranteed by design.

TABLE 6. 27C010T DC ELECTRICAL CHARACTERISTICS FOR READ OPERATION

($V_{CC} = 5V \pm 10\%$, $V_{PP} = V_{SS}$, $T_A = -55$ TO $+125$ °C, UNLESS OTHERWISE SPECIFIED)

PARAMETER	SYMBOL	TEST CONDITION	SUB GROUPS	MIN	TYP	MIN	UNIT
Input Leakage Current	I_{LI}	$V_{IN} = 5.5V$	1, 2, 3	--	--	2	μA
Output Leakage Current	I_{LO}	$V_{OUT} = 5.5V/0.45V$	1, 2, 3	--	--	2	μA
Standby V_{CC} Current	I_{SB}	$\overline{CE} = V_{IH}$	1, 2, 3	--	--	1	mA
Operating V_{CC} Current	I_{CC1}	$I_{OUT} = 0$ mA, $\overline{CE} = V_{IL}$	1, 2, 3	--	--	30	mA
	I_{CC2}	$I_{OUT} = 0$ mA, $f = 5$ MHz	1, 2, 3	--	--	30	
	I_{CC3}	$I_{OUT} = 0$ mA, $f = 10$ MHz	1, 2, 3	--	--	50	
V_{PP} Current	I_{PP1}	$V_{PP} = 5.5V$	1, 2, 3	--	1	20	μA
Input Voltage	V_{IH}		1, 2, 3	2.2	--	--	V
	V_{IL}		1, 2, 3	--	--	0.8	
Output Voltage	V_{OH}	$I_{OH} = -400$ μA	1, 2, 3	2.4	--	--	V
	V_{OL}	$I_{OL} = 2.1$ mA	1, 2, 3	--	--	0.45	

TABLE 7. 27C010T AC ELECTRICAL CHARACTERISTICS FOR READ OPERATION ¹(V_{CC} = 5V ± 10%, V_{PP} = V_{SS}, T_A = -55 TO +125 °C, UNLESS OTHERWISE SPECIFIED)

PARAMETER	TEST CONDITION	SYMBOL	SUB GROUPS	MIN	MAX	UNIT
Address Access Time - 120 - 150 - 200	$\overline{CE} = \overline{OE} = V_{IL}$	t _{ACC}	9, 10, 11	-- -- --	120 150 200	ns
Chip Enable Access Time - 120 - 150 - 200	$\overline{OE} = V_{IL}$	t _{CE}	9, 10, 11	-- -- --	120 150 200	ns
Output Enable Access Time - 120 - 150 - 200	$\overline{CE} = V_{IL}$	t _{OE}	9, 10, 11	-- -- --	60 70 70	ns
Output Hold to Address Change - 120 - 150 - 200	$\overline{CE} = V_{IL}$	t _{OH}	9, 10, 11	0 0 0	-- -- --	ns
Output Disable to High-Z ² - 120 - 150 - 200	$\overline{CE} = \overline{OE} = V_{IL}$	t _{DF}	9, 10, 11	0 0 0	50 50 50	ns

1. Test conditions:

- Input pulse levels 0.45V/2.4V
- Input rise and fall times ≤ 10 ns
- Output load 1 TTL gate + 100 pF (including scope and jig)
- Referenced levels for measuring timing 0.8V/2.0V

2. t_{DF} is defined as the time at which the output becomes an open circuit and data is no longer driven.

TABLE 8. 27C010T DC ELECTRICAL CHARACTERISTICS FOR PROGRAMMING OPERATIONS ^{1,2,3,4}
 ($V_{CC} = 6.25V \pm 0.25V$, $V_{PP} = 12.5V \pm 0.3V$, $T_A = 25^\circ C$)

PARAMETER	SYMBOL	TEST CONDITION	SUB GROUPS	MIN	MAX	UNIT
Input Leakage Current	I_{LI}	$V_{IN} = 0V$ to V_{CC}	1, 2, 3	--	2	μA
Operating V_{CC} Current	I_{CC}		1, 2, 3	--	30	mA
Operating V_{PP} Current	I_{PP}	$\overline{CE} = \overline{PGM} = V_{IL}$	1, 2, 3	--	40	mA
Input Voltage ⁵	V_{IH}		1, 2, 3	2.2	$V_{CC} + 5$ ⁶	V
	V_{IL}		1, 2, 3	-0.1 ⁷	0.8	
Output Voltage	V_{OH}	$I_{OH} = -400 \mu A$	1, 2, 3	2.4	--	V
	V_{OL}	$I_{OH} = 2.1 mA$	1, 2, 3	--	0.45	

- V_{CC} must be applied before V_{PP} and removed after V_{PP} .
- V_{PP} must not exceed 13V, including overshoot.
- Do not change V_{PP} from V_{IL} to 12.5V or 12.5V to V_{IL} when $\overline{CE} = LOW$.
- DC electrical parameters for programming operations are not tested. These parameters are guaranteed by design.
- Device reliability may be adversely affected if the device is installed or removed while $V_{PP} = 12.5V$.
- If V_{IH} is over the specified maximum value, programming operation can not be guaranteed.
- V_{IL} min = -0.6V for pulse width ≤ 20 ns.

TABLE 9. 27C010T AC ELECTRICAL CHARACTERISTICS FOR PROGRAMMING OPERATIONS ^{1,2}
 ($V_{CC} = 6.25V \pm 0.25V$, $V_{PP} = 12.5V \pm 0.3V$, $T_A = 25^\circ C$)

PARAMETER	SYMBOL	SUB GROUPS	MIN	TYP	MAX	UNIT
Address Setup Time	t_{AS}	9, 10, 11	2	--	--	μs
Address Hold Time	t_{AH}	9, 10, 11	0	--	--	μs
Data Setup Time	t_{DS}	9, 10, 11	2	--	--	μs
Data Hold Time	t_{DH}	9, 10, 11	2	--	--	μs
Chip Enable Setup Time	t_{CES}	9, 10, 11	2	--	--	μs
V_{PP} Setup Time	t_{VPS}	9, 10, 11	2	--	--	μs
V_{CC} Setup Time	t_{VCS}	9, 10, 11	2	--	--	μs
Output Enable Setup Time	t_{OES}	9, 10, 11	2	--	--	μs
Output Disable Time	t_{DF}	9, 10, 11	0	--	130	ns
PGM Initial Programming Pulse Width	t_{PW}	9, 10, 11	0.19	0.20	0.21	ms
PGM Overprogramming Pulse Width	t_{OPW}	9, 10, 11	0.19	--	5.25	ms
Data Valid from Output Enable Time	t_{OE}	9, 10, 11	0	--	150	ns
Output Enable Pulse During Data Latch	t_{LW}	9, 10, 11	1	--	--	μs
Output Enable Hold Time	t_{OEH}	9, 10, 11	2	--	--	μs
Chip Enable Hold Time	t_{CEH}	9, 10, 11	2	--	--	μs

TABLE 9. 27C010T AC ELECTRICAL CHARACTERISTICS FOR PROGRAMMING OPERATIONS ^{1,2}

($V_{CC} = 6.25V \pm 0.25V$, $V_{PP} = 12.5V \pm 0.3V$, $T_A = 25^\circ C$)

PARAMETER	SYMBOL	SUB GROUPS	MIN	TYP	MAX	UNIT
PGM Setup Time	t_{PGMS}	9, 10, 11	2	--	--	μs

1. Test conditions:

- Input pulse levels 0.45V / 2.4V
- Input rise and fall times ≤ 20 ns
- Referenced levels for measuring timing 0.8V/2.0V

2. AC electrical parameters for programming operation are not tested. These are guaranteed by design.

TABLE 10. 27C010T MODE SELECTION ^{1,2}

MODE	V_{PP}	V_{CC}	\overline{CE}	\overline{OE}	\overline{PGM}	A_0	I/O
READ	V_{CC}	V_{CC}	V_{IL}	V_{IL}	V_{PP}	X	D_{OUT}
OUTPUT DISABLE	V_{CC}	V_{CC}	V_{IL}	V_{IH}	V_{IH}	X	High-Z
STANDBY	V_{CC}	V_{CC}	V_{IH}	X	X	X	High-Z
PROGRAM	V_{PP}	V_{CC}	V_{IL}	V_{IN}	V_{IL}	X	D_{IN}
PROGRAM VERIFY	V_{PP}	V_{SS}	V_{IL}	V_{IL}	V_{IH}	X	D_{OUT}
PAGE DATA LATCH	V_{PP}	V_{CC}	V_{IH}	V_{IL}	V_{IH}	X	D_{IN}
PAGE PROGRAM	V_{PP}	V_{CC}	V_{IH}	V_{IH}	V_{IL}	X	High-Z
PROGRAM INHIBIT	V_{CC}	V_{CC}	V_{IL}	V_{IL}	V_{IL}	X	High-Z
	V_{PP}	V_{CC}	V_{IL}	V_{IH}	V_{IH}	X	High-Z
	V_{PP}	V_{CC}	V_{IH}	V_{IL}	V_{IL}	X	High-Z
	V_{PP}	V_{CC}	V_{IH}	V_{IH}	V_{IH}	X	High-Z
IDENTIFIER	V_{CC}	V_{CC}	V_{IL}	V_{IL}	V_{IH}	V_{IH}	ID

1. X = Don't care.

2. $11.5V \leq V_H \leq 12.5V$.

FIGURE 1. READ TIMING WAVEFORM

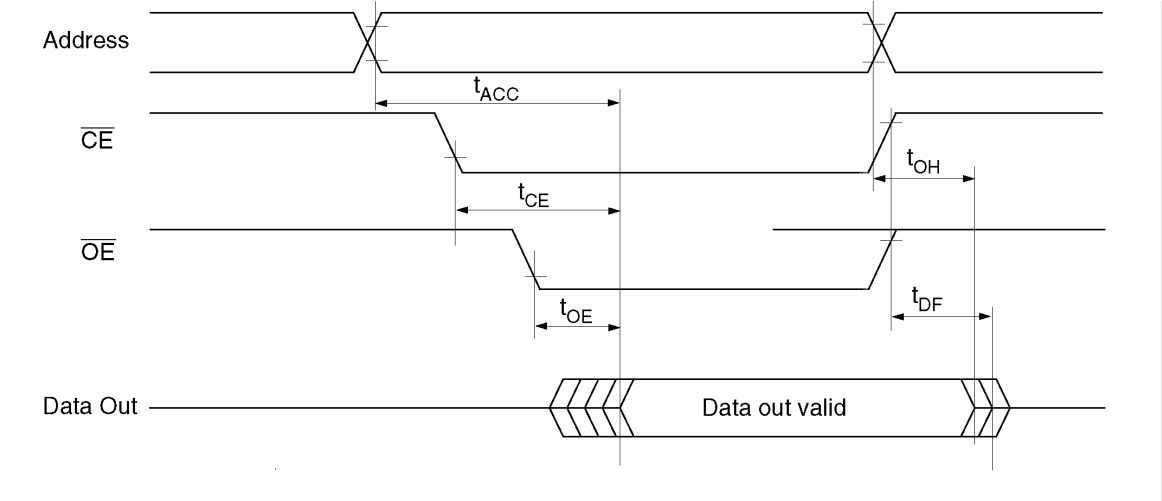


FIGURE 1.

FIGURE 2. BYTE PROGRAMMING FLOWCHART

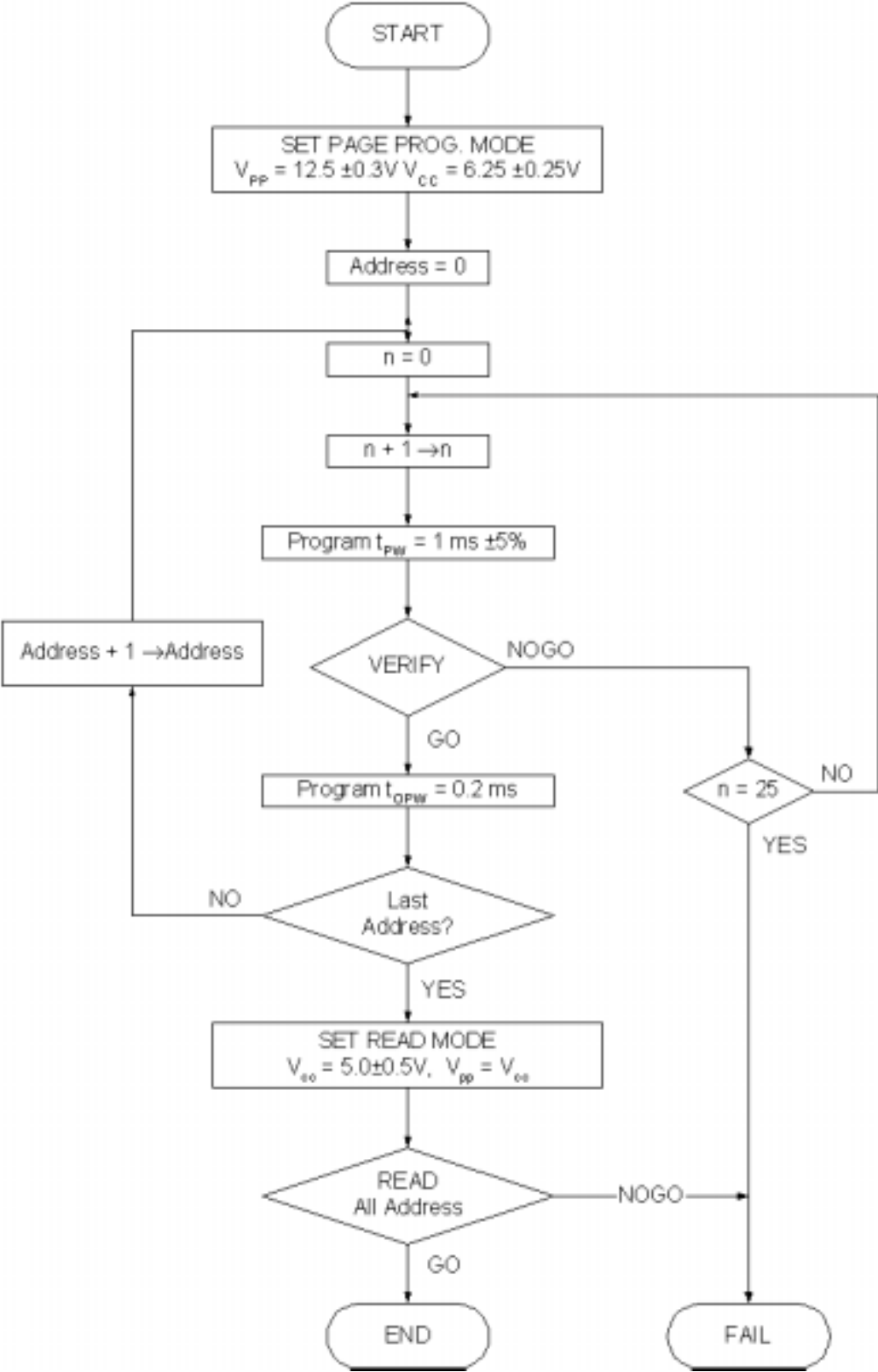


FIGURE 3. BYTE PROGRAMMING TIMING WAVEFORM

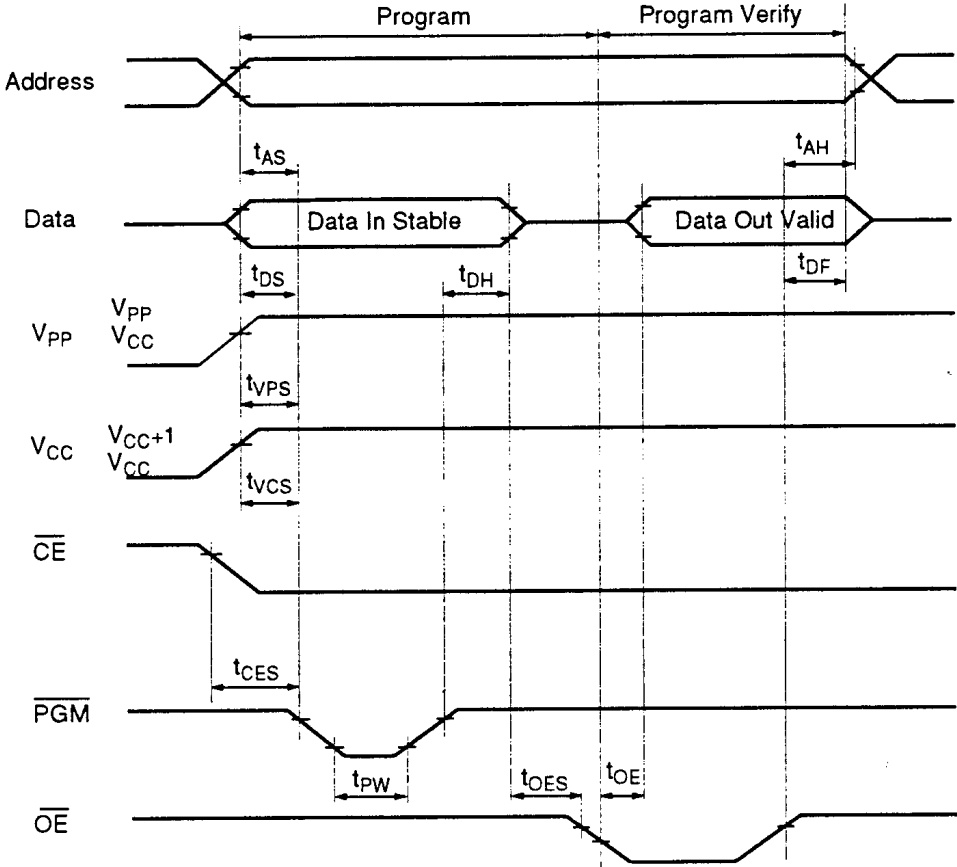
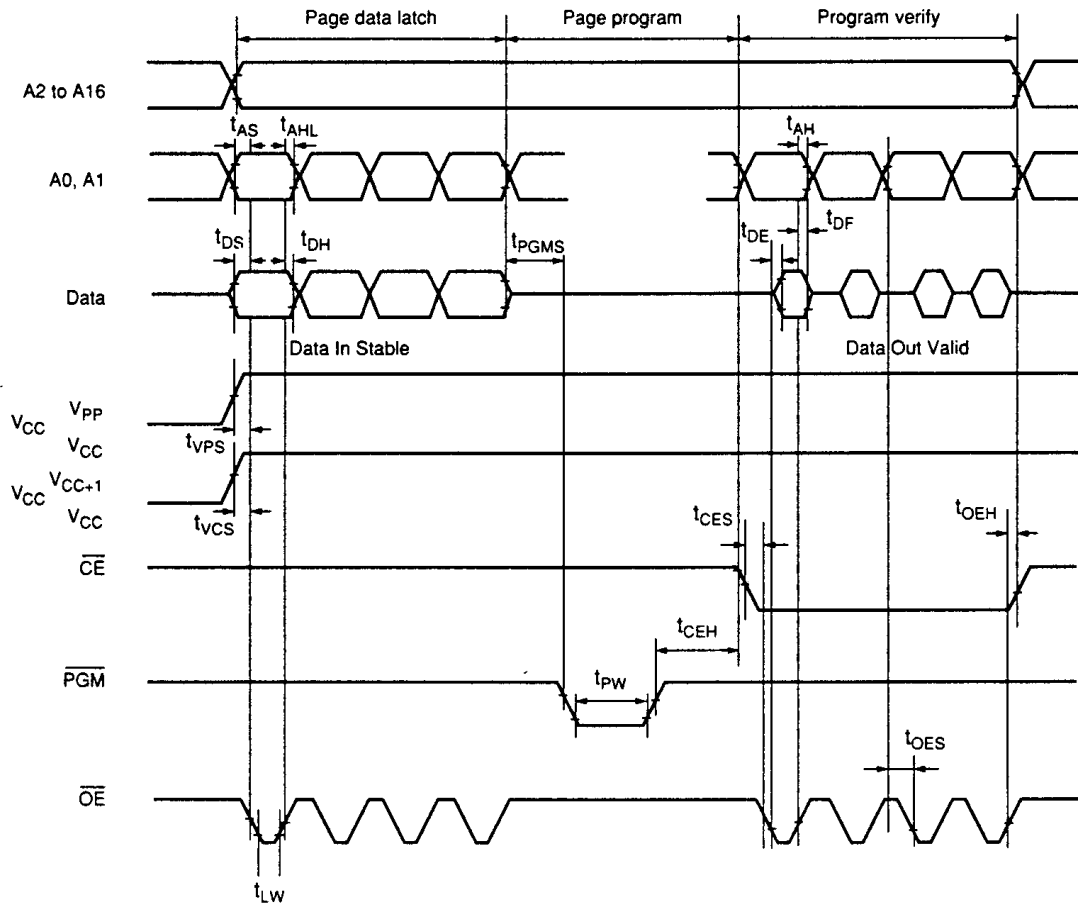
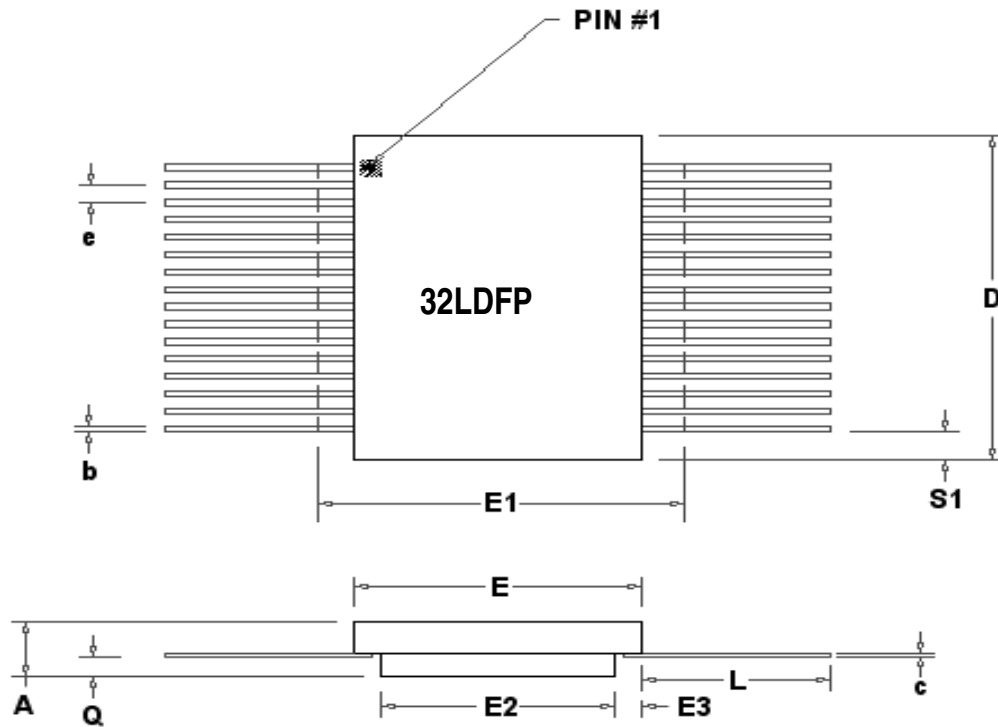


FIGURE 5. PAGE PROGRAMMING TIMING WAVEFORM





32 PIN RAD-PAK® FLAT PACKAGE

SYMBOL	DIMENSION		
	MIN	NOM	MAX
A	0.194	0.207	0.220
b	0.015	0.017 ±.002	0.019
c	0.004	0.005	0.007
D	0.812	0.820	0.828
E	0.474	0.480	0.486
E1	--	--	0.498
E2	0.304	0.310	0.316
E3	0.030	0.085	--
e	0.050 BSC		
L	0.370	0.380	0.390
Q	0.067	0.070	0.073
S1	0.005	0.027	--
N	32		

F32-09

Note: All dimensions in inches

Important Notice:

These data sheets are created using the chip manufacturer's published specifications. Maxwell Technologies verifies functionality by testing key parameters either by 100% testing, sample testing or characterization.

The specifications presented within these data sheets represent the latest and most accurate information available to date. However, these specifications are subject to change without notice and Maxwell Technologies assumes no responsibility for the use of this information.

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1 Megabit (128K x 8-Bit) - OTP EPROM

27C010T

Product Ordering Options

